

direct attachment of oxygen of an oxygen-containing functional group or a tertiary nitrogen atom substituted by two C₁-C₄-alkyl groups; or

a C₁-C₄-alkyl radical substituted by a pyrrolidone radical or a morpholine radical wherein the site of attachment of the pyrrolidone radical or the morpholine radical to the alkyl group is through the nitrogen atom of the ring system of the two cyclic groups, the diisocyanate component having been prepared by the reaction of isophorone diisocyanate, hexamethylene diisocyanate or a mixture thereof with a monoalcohol which determines substituent R³ in a molar ratio of the reacting diisocyanate to monoalcohol ranging from 1.5:1 to 20:1.--

REMARKS

Claims 11-21 are active in the case. Reconsideration is respectfully requested.

The present invention relates to a mixture of diisocyanates prepared by reacting isophorone diisocyanate, hexamethylene diisocyanate or a mixture of these diisocyanates with a 5- or 6-membered cycloaliphatic monoalcohol, an alkyl alcohol substituted by a 5- or 6-membered cycloalkyl group or a lower alkyl alcohol substituted by a pyrrolidone radical or a morpholine radical.

Claim Amendment

Claims 19 and 21 have been amended by incorporating the limitation of Claim 14 therein which specifies the molar ratio of reacting diisocyanate to monoalcohol which determines the structure of the claimed diisocyanate of formula (I). Because basis obviously exists for the amendment which has been made, entry of the amendment is respectfully requested.

Claim Rejection, 35 USC 112

Applicants have amended Claim 15 by incorporating the temperature at which the viscosity of the claimed mixture of the present invention is measured. This temperature is 25° C, support for which can be found in Table 1 of the specification. Entry of the amendment is respectfully requested, as well as withdrawal of the rejection of Claim 15 based on 35 USC 112.

Prior Art Rejection, 35 USC 102

Asa claimed, the invention is directed to a mixture of from 5 to 100 % by weight of a diisocyanate component of formula (I), from 0 to 20 % by weight of a urethane of formula (IV), from 0 to 30 % by weight of a diisocyanate of formula (V) and from 0 to 65 % by weight of a monoisocyanurate as set forth in Claim 19 above.

Another aspect of the invention is directed to a mixture of diisocyanates of formula (I) as set forth in Claim 21.

Still another aspect of the invention is a process for preparing the diisocyanate of formula (I) as set forth in Claim 14.

Claims 11-21 stand rejected based on 35 USC 102(b) as anticipated by Wolff et al U. S. Patent 5,369,207. This ground of rejection is respectfully traversed.

The disclosure of Wolff et al is clearly relevant to the present invention insofar as it discloses a polyisocyanate product prepared by the reaction of a diisocyanate, examples of which are disclosed in column 4, lines 29-55 and include hexamethylene diisocyanate and isophorone diisocyanate, with an alcohol of the types of monoalcohols disclosed in the paragraph bridging columns 4 and 5. The alcohols disclosed include cycloaliphatic alcohols such as cyclohexanol, ethylcyclohexanol and methylcyclohexanol. Despite the fact that the reference discloses hexamethylene diisocyanate, isophorone diisocyanate or mixtures thereof as diisocyanates which

react with a monoalcohol which can be the likes of cyclohexanol, ethylcyclohexanol and methylcyclohexanol, nevertheless, applicants submit that the patent would not lead one of skill in the art directly to the present invention as claimed because not only is the present invention specific to the two particular diisocyanate reactants indicated and no other diisocyanate reactant with only 5- or 6-membered cycloaliphatic monoalcohols or monoalcohols containing 5- or 5-membered radicals, but also the diisocyanate reactant or reactants must be reacted with the cyclic alcohol or alcohol containing a cyclic radical in a molar ratio of 1.5 to 20:1 as set forth in the active claims in order to obtain a diisocyanate product which contains a urethane group which in turn yields a coating on a substrate of the improved characteristics of the invention, in particular improved hardness.

It is evident upon further consideration of the patent, and in particular the examples of the same, that the patent contains no additional disclosure in which the specific limitations of the present claims are described. Note that in the many examples of diisocyanate products shown in the examples, that only one, i.e., Comp Ex (XI) (apparently IX) in Table II, shows a cyclic aliphatic alcohol (cyclohexyl alcohol) as a reactant with a diisocyanate reactant which is hexamethylene diisocyanate. Here, the amount of cyclohexanol employed is 2 mole % which means that the ratio of the diisocyanate reactant to cyclic alcohol is 50:1 which is substantially greater than the claimed ratio of the present claims of 1.5:1 to 20:1. Despite the fact that the patent discloses in column 5, lines 16-20 mole percent ranges for the amount of alcohol reacted with diisocyanate, nevertheless, these ranges do not suggest the specific mole ratio range of the present claims, as it particularly is pertinent to the reaction of the two diisocyanate reactants of the invention with the particular monoalcohol reactant of the present claims. Accordingly, on this basis it is believed that the anticipatory ground of rejection is obviated and withdrawal of the same is respectfully requested.

Moreover, applicants submit that the invention as claimed is not rendered obvious over the disclosure of Wolff et al. This is evident in substantial part from data in the present specification and in the Wolff et al patent. The following table compares characteristics of the products of Experiments 1 and 3 of the present application with Comp. Ex. IX of the Wolff et al.

	Product 1	Product 2	Comp. Product
Composition	HDI + 5 mol % Cyclohexanol, (see Exper. 1 of the present application)	HDI + 15 mol % Cyclohexanol, (see Exper. 3 of the present application)	HDI + 2 mol % Cyclohexanol, (see Comp.Ex. IX, U.S. Patent 5,369,207)
Viscosity (25° C) as disclosed	1220 mPas	890 mPas	1200 mPas (25° C)
Viscosity (23° C) as measured	1160 mPas	870 mPas	1290 mPas
NCO content as disclosed	20.7 %	18.3 %	22.2 %
NCO content as measured	20.6 %	18.2 %	21.8 %

The data in the table above clearly demonstrate important differences between the diisocyanate mixture of the present invention versus the most relevant example of a diisocyanate product described in Wolff et al in that the NCO content of the product embodiments of the present invention, i.e., Products 1 and 2, are lower than the NCO content of the Comp. Product of the patent, and in that the viscosities of the products of the present invention are less than the viscosity of the Comp. Product of the patent. Accordingly, given the differences noted above, the impact of the differences in the diisocyanates on the properties of coatings which are prepared from these diisocyanates are different with evident superiority of hardness being demonstrated by the product embodiments of the present invention as shown in the following table. Note that

in addition to three coatings prepared from the two compositions within the scope of the present invention and the composition of Wolff et al, a fourth example of a conventional coating is presented identified as BASONAT 100 which is presented in Table 2 of the present application.

	Product 1	Product 2	Comp Product (5,369,207)	Standard BASONAT HI 100
Polyisocyanate	Exper 1	Exper 2	Comp Ex IX	HI 100
Alcohol	Cyclohexanol			-
Hydroxy acrylate	H 136	H 136	H 136	H 136
Coating hardness Pendulum attenuation, Konig (swings)				
after 5 hr	15	13	14	15
after 7 d RT + 15 h 60° C	140	145	137	139

The results presented in the table above clearly demonstrate the superiority of coating embodiments within the scope of the present invention with respect to the important property of coatings of hardness in comparison to the coating within the scope of Wolff et al and also the coating prepared from the conventional product BASONAT HI 100. Applicants submit that one of skill in the art would not have expected ultimate coating products of improved hardness on the basis of viscosity of the diisocyanate component of a coating product, but which basis has now been demonstrated in the present invention. The coatings obtained from product embodiments of the present invention yield clearcoats of increased initial hardness, increased ultimate hardness and coatings which require less solvent (improved VOC values). Accordingly, it is submitted that one of skill in the art would not have found the present invention to be obvious over the disclosure

of Wolff et al.

Applicants will formalize the data presented above by the submission of an executed declaration (37 CFR 1.132) into the record of the case.

It is now believed that the application is in proper condition for consideration on its merits.

Respectfully submitted,

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DOCKET NO.: 192286US0PCT
SERIAL NO.: 09/581,560

MARKED-UP COPY OF AMENDMENT

IN THE CLAIMS

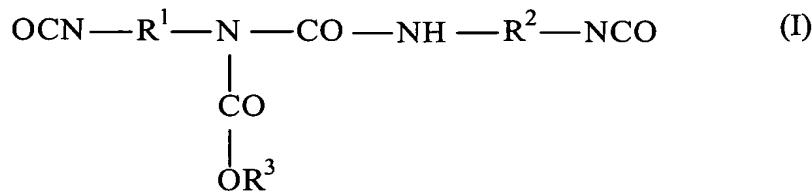
Please amend Claim 15 as follows:

--15. (Amended) The process as claimed in Claim 14, wherein the reaction is continued until the resulting reaction product after removal of unreacted isophorone diisocyanate or hexamethylene diisocyanate still present has a viscosity ranging from 100 to 10,000 mPas as measured at 25° C and determined by the procedure of ISO 3219, Annex B.--

Please amend Claims 19 and 21 as follows:

--19. (Amended) A mixture, comprising:

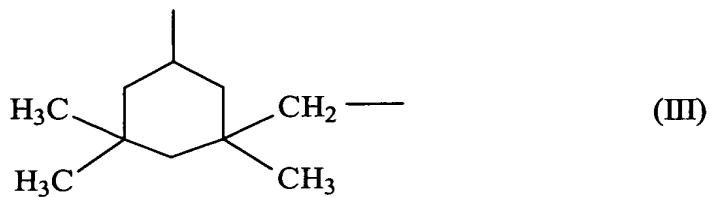
i) from 5 to 100% by weight of a diisocyanate component of formula Ia, Ib, Ic or combinations of diisocyanates of one or more of these three formulas, wherein diisocyanate of formula (Ia) is:



wherein each of R^1 and R^2 has formula (II):



diisocyanate of formula (Ib) wherein, in formula (I), one of R^1 or R^2 has formula (II) and the other radical has formula (III):



diisocyanate of formula (Ic) wherein, in formula (I), each of R¹ and R² has formula (III); R³ is a 5- or 6-membered cycloalkyl radical in which up to three hydrogen atoms are optionally substituted by C₁-C₄-alkyl groups and one or two ring carbon atoms are optionally substituted by direct attachment of oxygen of an oxygen-containing functional group or a tertiary nitrogen atom substituted by two C₁-C₄-alkyl groups;

a C₁-C₄-alkyl radical in which one hydrogen atom of the alkyl radical is substituted by a 5- or 6-membered cycloalkyl radical in which up to three hydrogen atoms are optionally substituted by C₁-C₄-alkyl groups and one or two ring carbon atoms are optionally substituted by direct attachment of oxygen of an oxygen-containing functional group or a tertiary nitrogen atom substituted by two C₁-C₄-alkyl groups; or

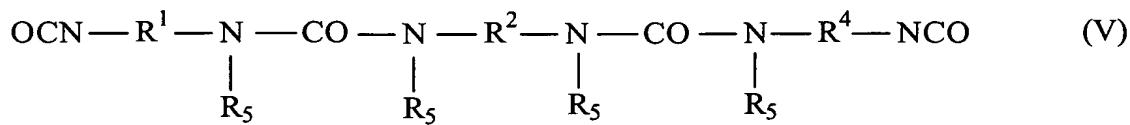
a C₁-C₄-alkyl radical substituted by a pyrrolidone radical or a morpholine radical wherein the site of attachment of the pyrrolidone radical or the morpholine radical to the alkyl group is through the nitrogen atom of the ring system of the two cyclic groups, the diisocyanate component having been prepared by the reaction of isophorone diisocyanate, hexamethylene diisocyanate or a mixture thereof with a monoalcohol which determines substituent R³ in a molar ratio of the reacting diisocyanate to monoalcohol ranging from 1.5:1 to 20:1;

ii) from 0 to 20% by weight of (ii) a urethane of formula (IV):

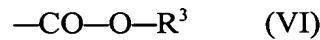


wherein R^1 has formula (II) or (III) above and R^3 is as defined above;

iii) from 0 to 30% by weight of (iii) a diisocyanate of formula (V):



wherein R^1 , R^2 and R^4 each have the meaning for group R^1 in formula (I), and wherein, of the four R^5 groups, two are hydrogen and the remaining two groups have formula (VI):



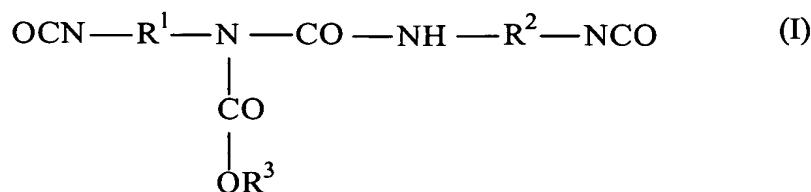
wherein R^3 is as defined above; and

iv) from 0 to 65% by weight of (iv) a monoisocyanurate (VII) prepared from isophorone diisocyanate or hexamethylene diisocyanate, wherein the percent amounts of (i), (ii) and (iii) and (iv) are based on the weight of the mixture.

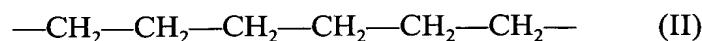
21. (Amended) A mixture, comprising:

a diisocyanate component of formula Ia, Ib, Ic or combinations of diisocyanates of one or more of these three formulas, wherein

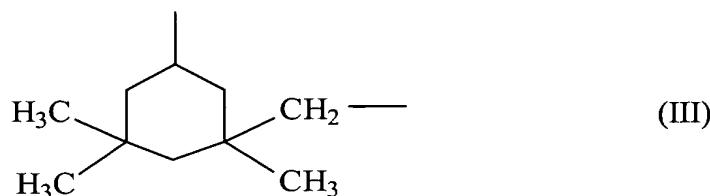
diisocyanate of formula (Ia) is:



wherein each of R¹ and R² has formula (II):



diisocyanate of formula (Ib) wherein, in formula (I), one of R¹ or R² has formula (II) and the other radical has formula (III):



diisocyanate of formula (Ic) wherein, in formula (I), each of R¹ and R² has formula (III); R³ is a 5- or 6-membered cycloalkyl radical in which up to three hydrogen atoms are optionally substituted by C₁-C₄-alkyl groups and one or two ring carbon atoms are optionally substituted by direct attachment of oxygen of an oxygen-containing functional group or a tertiary nitrogen atom substituted by two C₁-C₄-alkyl groups;

a C₁-C₄-alkyl radical in which one hydrogen atom of the alkyl radical is substituted by a 5- or 6-membered cycloalkyl radical in which up to three hydrogen atoms are optionally substituted by C₁-C₄-alkyl groups and one or two ring carbon atoms are optionally substituted by direct attachment of oxygen of an oxygen-containing functional group or a tertiary nitrogen atom substituted by two C₁-C₄-alkyl groups; or

a C₁-C₄-alkyl radical substituted by a pyrrolidone radical or a morpholine radical wherein the site of attachment of the pyrrolidone radical or the morpholine radical to the alkyl group is through the nitrogen atom of the ring system of the two cyclic groups, the diisocyanate component having been prepared by the reaction of isophorone diisocyanate, hexamethylene

diisocyanate or a mixture thereof with a monoalcohol which determines substituent R³ in a molar ratio of the reacting diisocyanate to monoalcohol ranging from 1.5:1 to 20:1.--